Notice of Allowability	Application No.	Applicant(s)	
	09/936,172	ADACHI ET AL.	
	Examiner	Art Unit	
	Abbas I Abdulselam	2674	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *10/28/04*.

2. ☒ The allowed claim(s) is/are *1, 4-7, 10-12, 15-17, 20-23, 26-28, 31-33, 36-39, 42-45, 48-51, 54-57, 60-63, 66-69, 72-75, 78-80, 83-85, 88-91, 94-97 and 100-102*.

3. ☒ The drawings filed on *10 September 2001* are accepted by the Examiner.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
      1. ☒ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

XIAO WU
PRIMARY EXAMINER

DETAILED ACTION

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Charles Wendell on March 9, 2005.

Claims 2-3, 8-9 13-14, 18-19, 24-25, 29-30, 34-35, 40-41, 46-47, 52-53, 58-59, 64-65, 70-71, 76-77, 81-82, 86-87, 92-93 and 98-99 are cancelled.

Independent claim 6 is amended for clarity to read as follows.

6. (Amended) A method of driving an active matrix display device wherein one image frame having a frame period comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale image is displayed on the device by the cumulative effects of the hold times, the method comprising: simultaneously with outputting a signal via each of signal lines, the value of the level of the signal level being selected from values of a plurality of signal levels in accordance with digital image data, the number of signal levels being at least three and fewer than the number of gray scales, [making] bringing [two] the degree of freedom of the signal levels usable for one gray scale within the period of the one frame[.] to two.

Allowable Subject Matter

2. Claims 1, 4-7, 10-12, 15-17, 20-23, 26-28, 31-33, 36-39, 42-45, 48-51, 54-57, 60-63, 66-69, 72-75, 78-80, 83-85, 88-91, 94-97 and 100-102 are allowed.

Reasons for Allowance

The following is an examiner's statement of reasons for allowance:

Troutman (USPN 6157356) teaches that a Gray-scale operation of the display in terms of dividing the frame time T.sub.f into multiple sub-frames T.sub.sfk and addressing all row lines during each sub-frame time. Troutman discloses that each column line is either V.sub.h or V.sub.l during the line time, and this voltage is written into the storage capacitor (104) of all pixels along the activated row line. Troutman also teaches that for n bits of gray scale, there are n sub-frames, and the sum of all sub-frame times equals the frame time T.sub.f. Troutman discloses that a pixel's luminance which is proportional to the sub-frame time, and each of the sub-frame times is weighted to produce the 2.sup.n gray scale levels. (Col. 3, lines 23-33).

Asari et al. (USPN 5644329) teach, during a selection time, an L number of signals developed on the time axis are applied to row electrodes as shown in formula (5).

Regarding claim 1, none of the cited prior art teaches or suggests art a method of driving an active matrix display device wherein one image frame comprises a plurality of sub-frames each having a sub-frame period comprising a write time and a hold time, and a gray scale image is displayed on the device by the cumulative effects of the hold times the method comprising: simultaneously with outputting a signal via each of signal lines, the value of the level of the

signal being selected from values of a plurality of signal levels in accordance with digital image data, the number of signal levels being fewer than the number of gray scales, randomly scanning scan lines, other than one predetermined scan line in a predetermined sequence during the hold time of each of the sub-frames corresponding to the one predetermined scan line so that any one sub-frame is not written to any one scan line more than once, wherein one image frame period is such that in each scan line, the writing of each of the plurality of sub-frames occurs and the hold time of each of sub-frames of said one image frame period is sufficiently long enough to permit gray scale display driving.

Regarding claim 4, none of the cited prior art teaches or suggests art a method of driving an active matrix display device wherein one image frame having a frame period comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale image is displayed on the device by the cumulative effects of the hold times, the method comprising: simultaneously with outputting a signal via each of signal lines, the value of the level of the signal being selected from values of a plurality of signal levels in accordance with digital image data and the number of the of signal levels being fewer than the number of gray scales, driving the display device such that the period of the frame is set to NH[1+K(2expo. N -1)]=NHL where N is the number of sub-frames, H is a horizontal scanning period, 1:2:4:...:2expo. N-1 is the weightings of the hold times, L is the number of scan lines, and K is a positive integer.

Regarding claim 5, none of the cited prior art teaches or suggests art a method of driving an active matrix display device wherein one image frame having a frame period comprises a

plurality of sub-frames each comprising a write time and a hold time and a gray scale image is displayed on the device by the cumulative effect of the hold times, the method comprising: simultaneously with outputting a signal via each of signal lines, the value of the level of the signal being selected from values of a plurality of signal levels in accordance with digital image data, and the number of signal levels being fewer than the number of gray scales, driving the display device such that the period of the frame is set to NH[1+ FK(i)] = NHL where N is the number of sub-frames, H is a horizontal scanning period, KW is the weighting of the hold time of the period of an ith sub-frame where i=1,2,..., N, and L is the number of scan lines.

Regarding claim 6, none of the cited prior art teaches or suggests an active matrix display device wherein one image frame having a frame period comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale image is displayed on the device by the cumulative effects of the hold times, the method comprising: simultaneously with outputting a signal via each of signal lines, the value of the level of the signal level being selected from values of a plurality of signal levels in accordance with digital image data, the number of signal levels being at least three and fewer than the number of gray scales, [making] bringing [two] the degree of freedom of the signal levels usable for one gray scale within the period of the one frame[.] to two.

Regarding claim 17, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a liquid crystal layer there between, the first substrate having formed thereon switching elements corresponding to the intersection points of a plurality of signal lines and a Plurality of scan lines arranged in a matrix, pixel electrodes connected to the switching elements, and storage capacitors connected to the pixel electrodes and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each having a sub-frame period comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effects of the hold times, the display device comprising a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being fewer than the number of display gray scales and a scan line driver circuit for randomly scanning the plurality of scan lines by scanning scan lines, other than one predetermined scan line in a predetermined sequence during the hold time of each of the sub-frames corresponding to the one predetermined scan so that any one sub-frame is not written to any one scan line more than once wherein one image frame period is such that in each respective scan line, the writing of each of the plurality of sub-frames occurs and the hold time of each of sub-frames of said one image frame period is sufficiently long enough to permit gray scale display driving.

Regarding claim 20, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate

with a liquid crystal layer there between, the first substrate having formed thereon switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, pixel electrodes connected to the switching elements, and storage capacitors connected to the pixel electrodes and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale is displayed on the device by the cumulative effects of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being fewer than the number of display gray scales and a scan line driver circuit for selecting the scan lines so that the period of the frame is NH[1+K(2expo. N -1)]=NHL where N is the number of sub-frames, H is a horizontal scanning period, 1:2:4:...:2expo. N-1 is the weightings of the hold times, L is the number of scan lines, and K is a positive integer.

Regarding claim 21, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a liquid crystal layer there between, the first substrate having formed thereon switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, pixel electrodes connected to the switching elements, and storage capacitors connected to the pixel electrodes and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each having a

sub-frame period comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effects of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being fewer than the number of display gray scales and a scan line driver circuit for selecting the scan lines so that the period of the frame is NH[1+ EK(i)] = NHL where N is the number of sub-frames, H is a horizontal scanning period, K(i) is the weighting of the hold time of the period of an ith sub-frame where i=1,2,..., N, and L is the number of scan lines.

Regarding claim 22, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a liquid crystal layer there between, the first substrate having formed thereon switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, pixel electrodes connected to the switching elements, and storage capacitors connected to the pixel electrodes and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effect of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being at least three and fewer than the number of display gray

scales and the selection being carried out so that the degree of freedom of the voltage levels usable for one gray scale within the period of the one frame is two; and a scan line driver circuit for sequentially scanning or randomly scanning the scan lines.

Regarding claim 69, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a luminescent layer there between, the first substrate having formed thereon first switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, second switching elements connected to the first switching elements, pixel electrodes connected to the second switching elements, and power supply lines connected to a side of the second switching elements differing from that to which the pixel electrodes are connected and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each having a sub-frame period comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effects of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage - levels being fewer than the number of display gray scales and a scan line driver circuit for randomly scanning the plurality of scan lines by scanning scan lines, other than one predetermined scan line in a predetermined sequence during the hold time of each of the sub-frames corresponding to the one predetermined scan so that any one sub-frame is not written to any one scan line more than once wherein one image frame period is

such that in each respective scan line, the writing of each of the plurality of sub-frames occurs and the hold time of each of sub-frames of said one range frame period is sufficiently long enough to permit gray scale display driving.

Regarding claim 72, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a luminescent layer there between, the first substrate having formed thereon first switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, second switching elements connected to the first switching elements, pixel electrodes connected to the second switching elements, and power supply lines elements connected to the first switching elements, pixel electrodes connected to the second switching elements, and power supply lines connected to a side of the second switching elements differing from that to which the pixel electrodes are connected and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effects of the hold times, the display device comprising a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being fewer than the number of display gray scales; and a scan line driver circuit for selecting the scan lines so that te period of the frame is NH[1+K(2 expo N-1)] where Ni si the number of sub-frames, H is a horizontal

scanning period, 1:2:4...:2 (expo. N-1) is the weightings of the hold times, L is the number of scan lines, and K is a positive integer.

Regarding claim 73, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a luminescent layer there between, the first substrate having formed thereon first switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, second switching elements connected to the first switching elements, pixel electrodes connected to the second switching elements, and power supply lines connected to a side of the second switching elements differing from that to which the pixel electrodes are connected and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale, is displayed on the device by the cumulative effects of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being fewer than the number of display gray scales and a scan line driver circuit for selecting the scan lines so that the period of the frame is NH[1+ EK(i)] = NHL where N is the number of sub-frames, H is a horizontal scanning period, K(i) is the weighting of the hold time of the period of an ith sub-frame where i=1,2,..., N, and L is the number of scan lines.

Regarding claim 74, none of the cited prior art teaches or suggests art an active matrix display device including a first substrate and a second substrate confronting the first substrate with a luminescent layer there between, the first substrate having formed thereon first switching elements corresponding to the intersection points of a plurality of signal lines and a plurality of scan lines arranged in a matrix, second switching elements connected to the first switching elements, pixel electrodes connected to the second switching elements, and power supply lines connected to a side of the second switching elements differing from that to which the pixel electrodes are connected and the second substrate having formed thereon a counter electrode, wherein one image frame comprises a plurality of sub-frames each comprising a write time and a hold time, and a gray scale is displayed on the device by the cumulative effect of the hold times, the display device comprising: a signal line driver circuit for selecting a value of a voltage level from values of a plurality of voltage levels in accordance with digital image data and outputting a voltage having the selected value via each of the signal lines, the number of the plurality of voltage levels being at least three and fewer than the number of display gray scales and the selection being carried out so that the degree of freedom of the voltage levels usable for one gray scale within the period of the one frame is two; and a scan line driver circuit for sequentially scanning or randomly scanning the scan lines.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Abbas I Abdulselam** whose telephone number is **(571) 272-7685.** The examiner can normally be reached on Monday through Friday from 9:00 A.M. to 5:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Patrick Edouard**, can be reached on **(571) 272-7603**. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Abbas Abdulselam

Examiner

Art Unit 2674

March 9, 2005

XIAO WU
PRIMARY EXAMINER